Expanding the Concawe REACH inventory: integration of renewable fuel substances

Concawe, has responded to the evolving landscape of energy and climate policy by expanding its scope to encompass the scientific study of renewable liquid fuel substances. This article presents an in-depth review of the strategic rationale, scientific challenges and practical implementation of integrating these novel substances into the Concawe REACH portfolio.

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Strategic context: expanding the scope of Concawe

The Board decision taken by the European Fuel Manufacturers Association in July 2022 represents a landmark evolution in Concawe's mandate. As the industry recognises the pressing need for decarbonisation, liquid fuels derived from renewable sources are expected to play a pivotal role in sectors where electrification is less viable. The extension of Concawe's scope to include renewable fuels—such as hydrotreated vegetable oils (HVO), Fischer-Tropsch fuels, waste-derived naphtha and e-fuels—was a logical progression aligned with Europe's 2050 climate neutrality ambition. This strategic expansion allows the sector to consolidate scientific and regulatory efforts under a single expert umbrella, while fostering innovation in compliance mechanisms.

The integration of renewable fuel substances is not only a response to policy directives but a proactive engagement with future regulatory expectations. The fuels landscape is shifting towards life-cycle carbon intensity benchmarks, and regulatory frameworks are beginning to require traceability, sustainability criteria and greenhouse gas reduction calculations that incorporate upstream emissions. In this context, expanding Concawe's role to include renewable substances enables early preparation for substance-level compliance, as well as system-level conformity with emerging legislative instruments such as the Renewable Energy Directive III (RED III) and the Sustainable Finance Disclosure Regulation (SFDR). This foresight strengthens the credibility of Concawe's scientific output and ensures its continued relevance in European policy arenas. Moreover, the consolidation of renewable and fossil fuel data under one framework allows the development of harmonised risk assessment methodologies and supports consistency in hazard communication.

Concawe's evolving role in REACH registration management

Concawe's current role as a facilitator of EU REACH compliance for complex hydrocarbon substances is well established. Managing over 140 substances and more than 4,000 registrations, Concawe supports joint submission dossiers, maintains substance identity profiles (SIPs), and oversees technical consistency with the latest IUCLID[1] requirements. The organisation acts as an interface between industry and the European Chemicals Agency (ECHA), responding to regulatory developments and guiding registrants in dossier updates. The extension to include non-fossil hydrocarbons builds on this foundation, reinforcing the continuity of scientific oversight and enabling efficient integration into ongoing dossier evaluation cycles. Concawe's infrastructure includes dedicated scientific and technical groups, such as the Substance Identity Management Group (SIMG), Environmental Management Group (EMG) and Health Management Group (HMG). These teams collaborate to commission appropriate studies, evaluate data and ensure alignment with ECHA's evolving guidance. The ongoing maintenance of joint dossiers includes validation against technical completeness checks, ensuring that dossier content reflects current data and regulatory requirements. Concawe's active participation in ECHA workshops, technical panels and evaluation processes ensures a bidirectional flow of knowledge and helps shape regulatory expectations in a manner that reflects the practicalities of complex substance management.

[1] https://echa.europa.eu/support/registration/creating-your-registration-dossier/what-is-iuclid-

Within this system, new substance integration is not merely administrative, but is an iterative scientific process. The transition to incorporate renewable substances benefits from this mature regulatory interface, enabling a smoother transition for registrants and a more consistent interpretation by regulators.

Scientific and strategic value of integration

Integration of renewable substances into the Concawe hydrocarbon substance inventory requires scientific assertion of similarity in risk and behaviour under REACH. A key benefit lies in the ability to apply read-across principles. When structural and compositional similarity can be demonstrated, substances may share toxicological and environmental data, reducing the need for new animal testing and aligning with the principles of the REACH Regulation.[1] This contributes to both ethical testing standards and cost efficiency for registrants. Moreover, centralised dossier management reduces duplication and ensures harmonised interpretation of regulatory standards, something that is particularly important for UVCBs where category membership must be substantiated by compositional and biological similarity.[2] Centralising the REACH compliance strategy for both fossil and renewable hydrocarbons improves resource efficiency and scientific cohesion. Integration reduces redundancy by enabling data-sharing across substances with demonstrated similarity, thus fulfilling REACH's aim of minimising animal testing. In addition, Concawe's approach allows registrants of newer fuels to benefit from established datasets and evaluation strategies, including the PetroTox model for aquatic toxicity estimation.[3] For the regulatory community, the value lies in receiving dossiers that are better structured, more transparent in justification, and supported by consistent evidence bases. From a policy perspective, such harmonisation supports the EU's broader goals of promoting circularity, resource efficiency, and safe innovation in the chemicals and energy sectors.

Challenges in the integration of new substances

Despite the strategic imperative, integrating new substances presents several technical and procedural challenges. First, the demonstration of structural similarity requires comprehensive analytical characterisation. An example of this is the use of two-dimensional gas chromatography (GCxGC) enabling hydrocarbon space mapping—a methodology pioneered by Concawe to define compositional boundaries across hydrocarbon classes and carbon number distributions.[2] This analytical technique is resource intensive, requiring five independent samples for each new substance candidate. A second challenge is establishing biological similarity, typically using screening studies such as OECD 422 for human health hazards to compare profiles with category members.[4] Even when such similarity is confirmed, regulatory hurdles remain. Inclusion of a new substance into a category already under ECHA evaluation introduces additional review layers, and necessitates coordination between registrants and Concawe to address financial and data-sharing commitments. Another significant challenge lies in aligning substance identity with ECHA expectations for UVCBs. For many renewable fuels, especially those involving co-processing or pyrolysis of mixed feedstocks, the complexity of composition extends beyond classical hydrocarbon profiles.

Trace elements, minor impurities or oxygenated compounds may complicate the assessment. Furthermore, each registrant's production method may result in slight variations, requiring extensive dialogue to determine whether multiple registrants can adopt a unified approach within a single dossier. Concawe facilitates this harmonisation by coordinating study selection, defining testing strategies and ensuring comparability across datasets. However, limitations in current analytical technology sometimes impede full characterisation. For example, GCxGC cannot reliably separate hydrocarbon substance constituents above a carbon number of around 30, and alternative methods like field ionisation mass spectrometry (FIMS) or high-performance liquid chromatography (HPLC) must be employed. The iterative nature of this process places substantial demands on technical capacity and registrant engagement.

Current integration status and substance examples

As of early 2025, eight new renewable or co-processed substances have been accepted into the Concawe inventory. These range from diesel-type HVO products (EC 951-915-5) to co-processed streams incorporating chemically recycled plastics (e.g. EC 941-803-4). Each substance involved a multi-step evaluation: initial dossier review, comparison against target category justification documents, hydrocarbon space mapping, and—where necessary—OECD 422[2] biological testing. The experiences gained from these integrations highlight both the benefits of centralised dossier management and the importance of early and thorough data generation. For example, the integration of EC 941-379-0, a petroleum kerosene fraction co-processed with plant-based inputs, demonstrated that structural overlap with existing substances can be established even when feedstock origin varies significantly. In contrast, substances originating from chemically recycled plastics required more extensive justification due to the potential presence of unknown or non-hydrocarbon constituents.[5]

The eight new substances serve as a valuable testbed for refining integration protocols. Substances such as EC 940-595-2, a renewable naphtha from animal and vegetable origin will be assessed for its similarity to other naphtha substances in the near future, starting with profiling of each constituent type and concentration using direct hydrocarbon analysis - gas chromatography. In the absence of evidence of structural and biological similarity, the decision to manage the substance as a stand-alone entry rather than forcing category inclusion demonstrates Concawe's commitment to scientific integrity. Each integration case contributes to a growing body of knowledge and helps calibrate the thresholds and benchmarks used in assessing future candidates. This knowledge is also informing guidance materials and framework documents for registrants, improving transparency and predictability of the process.

[2] Test No. 422: Combined Repeated Dose Toxicity Study with the Reproduction/Developmental Toxicity Screening Test. https://doi.org/10.1787/9789264242715-en

Conclusions and outlook

The inclusion of renewable fuel substances into the Concawe REACH inventory underscores the Association's commitment to both regulatory leadership and climate responsibility. By applying rigorous scientific methodologies such as hydrocarbon space mapping and compositional fingerprinting, Concawe is building a framework where substance integration is not only feasible but strategically beneficial. Looking forward, the ability to support increasingly diverse sources of hydrocarbon liquids—ranging from biomass to synthetic and chemically recycled feedstocks—will be central to the evolution of regulatory science in the fuels sector. Concawe's experience and infrastructure place it in a unique position to lead this transition, ensuring that scientific integrity and regulatory compliance remain at the forefront of sustainable fuel development.

Looking ahead, the continuous evolution of Concawe's integration framework will be essential as the number and diversity of candidate substances increase. Future developments may include refinement of hydrocarbon space mapping algorithms, integration of in vitro and NAMs[3] data for hazard assessment, and further collaboration with analytical laboratories to standardise compositional fingerprinting. Furthermore, engagement with ECHA will remain critical to ensure mutual understanding of expectations and acceptable methodologies. There is also scope for harmonising Concawe's inventory with broader EU-level sustainability criteria, including carbon intensity metrics and circular economy indicators. In doing so, Concawe can support not only regulatory compliance but also strategic positioning of its members in the transition to sustainable energy systems. Ultimately, a robust, scientifically sound and transparent integration process will underpin industry confidence and stakeholder trust.

References

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[3] New approach methodologies—alternatives to animal testing methods in the hazard assessment of industrial chemicals.